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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 749

Contribution from the Forest Service
HENRY S. GRAVES, Forester

Washington, D. C. April 30, 1919

PRODUCTION OF GOATS ON FAR WESTERN RANGES

By

W. R. CHAPLINE
Grazing Examiner

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THE GOAT RANGE PROBLEM.

On far western ranges goats are raised mainly for mohair and meat and secondarily for milk and hides. On farms they are valuable also for clearing brush. The possibility of clearing brushy areas by heavy stocking with goats and the excessive overgrazing and injury to the range which has resulted on many goat ranges from lack of proper management have created the impression that goat grazing can not be conducted without unwarranted damage to range and timber reproduction. Furthermore, a lack of proper selection, care, and management of the range goats has resulted in a low average production of mohair and meat and small profits. There are individuals, however, who have improved their methods of management for the range and the goats so that they have eliminated overgrazing and injury to the range and established a profitable business. The adoption of similar improved methods more generally by range goat growers would greatly decrease injury to the range and to tree growth and watersheds where these are factors, and would place the range goat industry upon a more stable and remunerative basis.

The goat range problem to-day has three important phases: first, determining the character of range suitable for goat grazing; second, developing methods of management of goat range which will insure profitable production of goats without detriment to cattle and sheep raising, timber reproduction, watershed protection, and other uses of

the land; third, increasing the production of mohair and meat by decreasing loss and by better selection, care, and management of the goats. Investigations have been made of all these phases of the problem and the results are incorporated in this bulletin in the following order: (1) the character of range required by goats; (2) methods of management of range which will insure profitable goat production without effects detrimental to the other uses of the area grazed; and (3) the selection, care, and management of goats so as to increase the production of mohair and meat.

RANGE SUITABLE FOR GOATS.

The suitability of range for goats depends to some extent upon climate and water, but chiefly upon forage.

The ideal goat range should possess forage suitable for goats at all times of the year, be well drained and free from continued heavy rains, and be adequately supplied with watering places and suitable bed grounds. Since browse furnishes the bulk of range feed for goats throughout the year, there should be an abundance of this available. Grass and weeds are necessary for does and kids during the spring and summer, but not during the winter. They are not essential for wethers at any time. They are of considerable value at all times, however, to give variety to the forage. On extensive brush areas, the stand of brush should be sufficiently open to allow herding of the goats. On small areas the brush may be dense. Extensive areas where brush grows too dense for immediate use can eventually be made wholly usable by allowing the herds to graze into them gradually from adjacent more open areas.

The value of the different kinds of range forage plants varies greatly with variation in the associated plant species, the stage of growth, the region, and the tastes of individual goats. However, it is the general opinion that the relative importance of browse, grasses, and weeds is in the order named.

BROWSE.

Browse furnishes most of the forage for goats on the ranges. During the summer browse and grass are often grazed in approximately equal quantity, provided about equal amounts of palatable species of both make up the forage. In the winter, however, browse is the principal goat feed, and it is absolutely necessary on any winter goat range which is subject to continued snow. Evergreen browse species are of value throughout the year, but are ordinarily grazed most during the winter. Deciduous species are of greatest value during the summer, but twigs and buds of such species often furnish much winter forage.

Browse should be available on kidding ranges, to provide buds, fresh leaves, tender twigs, and variety in the feed, which are fundamental requirements, especially when the growth of grass is deferred by drought or late season.

Nearly all species of browse are grazed to some extent by goats, though certain species are of much greater value than others. The species of mountain mahogany (*Cercocarpus spp.*) are among the most important kinds of goat forage. They are very palatable, abundant, and widely distributed; they produce a large amount of forage; are not easily injured by grazing; and most of them are evergreen.

The palatable oaks (*Quercus spp.*) also furnish a considerable proportion of the browse forage for goats. The evergreen oaks are of great importance throughout the entire year. Gambel oak (*Q. gambelii*), New Mexican oak (*Q. novomexicana*), and other deciduous oaks are of value chiefly during the summer, not only because they drop their leaves in winter but because ordinarily they grow at elevations too high for satisfactory winter use. The oaks are generally of only moderately high palatability; they derive their importance as goat forage chiefly from their distribution and abundance. Several other important browse species of moderately high palatability are garrya [1] (*Garrya spp.*), maple (*Acer spp.*), snowberry (*Symphoricarpos spp.*), cherry (*Prunus spp.*), willow (*Salix spp.*), sage (*Artemisia spp.*), and Apache plume (*Fallugia paradoxa*).

The blue brush [2] (*Ceanothus integerrimus*) of the Pacific coast and Fendler's ceanothus (*C. fendleri*) of the Rocky Mountains are of very high forage value. The blue brush is probably the most valuable browse species on the Pacific coast. Several other species of ceanothus [3] furnish considerable forage for goats. Other important browse species of very high palatability are fendlera (*Fendlera spp.*), bitter brush (*Kunzia tridentata*), lemita or skunk bush (*Schmaltzia spp.*), New Mexican locust (*Robinia neomexicana*), service berry (*Amelanchier spp.*), and rose (*Rosa spp.*).

Manzanita (*Arctostaphylos spp.*) is grazed rather freely in southern New Mexico, but in California and Oregon it is eaten only when the range is overgrazed. In the spring it is often peeled by the goats, apparently for the sap.

There are undoubtedly many other browse species of high forage value for goats. Additional observations are necessary to determine their importance. Among such species are probably simmondsia

[1] Locally called quinine bush.

[2] Also called wild lilac, sweet birch, and white birch.

[3] Some of the most important are Gregg's ceanothus (*C. greggii*), white thorn (*C. cordulatus*), red ceanothus (*C. sanguineus*), and wedge-leaved ceanothus (*C. cuneatus*), locally called "chamise."

(*Simmondsia californica*), palo verde (*Parkinsonia spp.*), franseria (*Franseria dumosa*), mesquite (*Prosopis glandulosa*), and screw-bean (*Strombocarpa pubescens*).

The berries of the cedars (*Juniperus spp.*) and junipers (*Juniperus spp.*) and the nuts of piñon (*Pinus edulis*) are eaten readily by goats; but conifers as forage for goats are of low value and, as a general rule, are not seriously grazed when there is a sufficient amount of more palatable browse available. Frequently, however, on overgrazed goat ranges there is considerable injury to conifer reproduction.

GRASSES.

It is essential to have grass available for does at kidding time and during the summer, to provide succulent forage so that there may be an adequate supply of milk for the kids. Young kids also receive much nourishment from grass forage.

Many grass species are of high value for goats during the summer, and give an excellent "finish" to the flesh of those which are to be sold for meat in the fall. As grass becomes coarse and tough in the fall it becomes less palatable to goats, and generally from this time on through the winter it is grazed very little.

Where grass grows scattered in dense brush stands, it is more closely grazed than where it forms a considerable part of the forage.

On southwestern ranges the gramas[1] and eragrostes[2] are probably the most valuable grasses for goat grazing. Of medium palatability are some of the muhlenbergias,[3] small feather-grass (*Andropogon scoparius*), piñon mountain-rice (*Oryzopsis fimbriata*), prairie-grass (*Sphenopholis obtusata*), and wolftail (*Lycurus phleoides*). Grasses of low palatability are grazed only when the range is overgrazed or when there is a scarcity of grass.

WEEDS.

The herbaceous flowering plants, "weeds" as they are generally called on National Forest ranges, are usually of greater palatability when green and tender than when dry. Accordingly, they furnish little feed during the winter, but are often important at other times of the year. Alfileria (*Erodium cicutarium*) on low ranges, however, furnishes considerable winter feed. The chief value of most weeds lies in providing variety in the forage for does and kids during the spring and summer.

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[1] Side oats (*Bouteloua curtipendula*), blue grama (*B. gracilis*), and hairy grama (*B. hirsuta*).

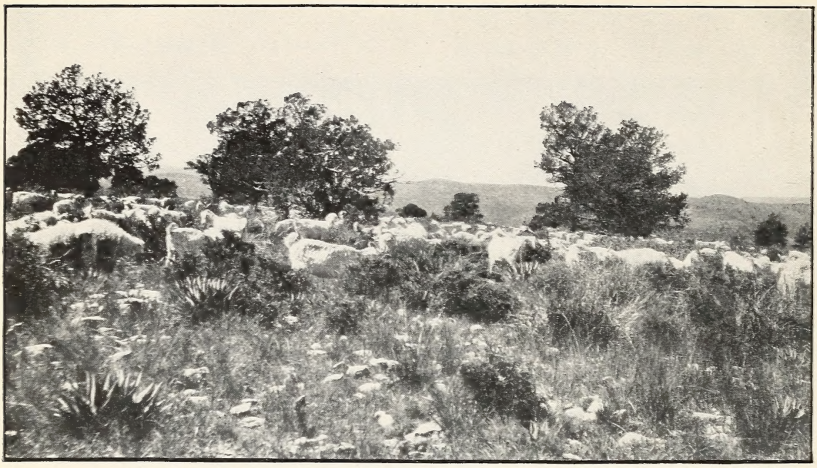
[2] Panicled eragrostis (*Eragrostis erosa*) and Mexican eragrostis (*E. mexicana*.)

[3] Wright's muhlenbergia (*Muhlenbergia wrightii*) and Berlandier's muhlenbergia (*M. berlandieri*).

F-1-WRC

A BUNCH OF EXCELLENT KIDS, ABOUT 6 MONTHS OLD.

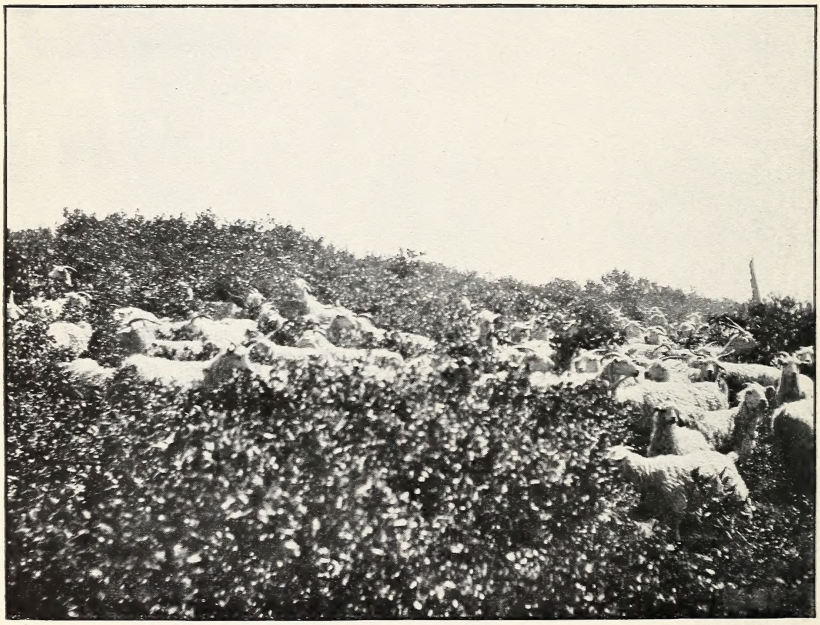
Careful selection and breeding in conjunction with good care and management are essential for the production of such animals.



F-2-WRC

FIG. 1.—GOATS GRAZING ON GRASS-BRUSH RANGE.

A mixture of grasses, browse, and weeds furnishes the most desirable range for goats. Variety of forage is especially important for does and kids.



F-3-WRC

FIG. 2.—GOATS GRAZING IN DENSE BRUSH.

Extensive areas of dense palatable brush may be utilized by working the goats in gradually from adjacent open areas.

SUPPLEMENTAL FEED.

If range forage is covered with snow for more than a few days at a time, some other feed must be provided for the goats. On northern ranges and at high altitudes this condition sometimes prevails for long periods. On most winter ranges in the Southwest light snows which soon melt are the rule, so that little feeding is necessary. However, even here a small amount of supplemental feed on wintry days and during kidding will pay for itself by keeping the animals in good condition.

All kinds of hay from alfalfa or clover to dried brush or straw can be fed advantageously. Where alfalfa, clover, vetch, or cowpeas are fed no grain is necessary; but it is well to supplement rough fodder with cottonseed cake, oats, barley, or other grains. Roots are sometimes fed as a substitute for green feed. Goats like good feed and will ordinarily not eat anything soiled by dirt or trampled. Accordingly, they have sometimes been considered wasteful. To prevent waste, hay should be fed in a feeding rack and grain in troughs. The amount of hay and grain fed depends largely on whether the object of feeding is merely to prevent loss or to keep the goats in a thrifty, growing condition. With most range herds, from 1 to 2 pounds of hay or from one-quarter to 1 pound of cottonseed cake are fed to each goat on days when they are unable to obtain sufficient range feed.

CLIMATE.

Climate limits the suitability of range for goats through the effect of heavy rains and snows. Dry, rugged areas are generally better suited for goat grazing than wet, marshy lands. Goats seek the shelter of timber or of sheds during heavy rains. Continued cold rains may keep them unduly confined to sheds and have often caused serious losses soon after shearing where sheds were not available. The heavy losses that have occurred in the fog belt near the coast of northern California and southwestern Oregon would indicate that areas subject to heavy fogs and rains are not well suited for goat ranges. Despite these heavy losses, however, small herds of goats are being grown successfully in portions of the fog belt, though they require more care in sheltering and handling than where the climate is drier. Ranges subject to heavy snowfall should not be used for winter grazing unless warm, dry sheds, and plenty of supplemental feed are provided.

WATER.

The amount of stock water available determines the suitability of a given range for goats, especially at certain seasons of the year. Abundant water should be available on ranges used during the spring

and summer. It is not necessary to have very much water on winter ranges if snow is available. Pure, fresh water should be provided wherever possible, but in the Southwest it is often necessary to utilize rain water caught in large storage reservoirs. The goats drink this readily when once accustomed to it.

Deep wells must sometimes be drilled on southwestern ranges if there is to be a supply of water throughout the year. The cost of such operations is often prohibitive considering the amount of forage available in the locality. When this is true such areas are sometimes used only during the rainy seasons and when stored rain water can be used.

MANAGEMENT OF THE GOAT RANGE.

Most goat ranges are used throughout the year. This and the general practice of driving the goats out from a corral at the ranch headquarters and back every day for months or throughout the year have been largely responsible for such a deterioration of the range as to cause a widespread belief that any grazing by goats is extremely destructive to range. The fault is largely in the method of management, which with large herds is sure to concentrate grazing to the point of overstocking and to cause continued premature grazing. Where a similar practice has been followed in the management of cattle and sheep, the range has been similarly depleted.

The remedy lies in working out a plan of grazing which will give the vegetation a chance to grow sufficiently to maintain itself. To do this on an area which is grazed throughout the year necessitates light stocking, at least during the main growing season of the important forage plants. Investigation and practical tests have shown that a better plan is to divide the range into three areas, one for spring, another for summer and fall, and a third for winter. Dividing the range for seasonal use so as best to meet the needs of the forage and of the goats and distributing the grazing more evenly over the range make possible the maintenance of the forage under heavier grazing and the reservation of suitable feed for the most critical periods of the year.

DIVISION OF THE RANGE.

Spring range.—During the period of kidding and immediately afterwards more than during any other period of the year the does and kids need plenty of green, tender feed and plenty of water. For this reason there should be an abundance of grass and weed forage on the kidding range, but there should also be some browse to provide tender, green twigs in case drought or a late season prevents a sufficient growth of grass.

It is important that this vegetation be kept thrifty, so that growth will start promptly and vigorously as soon as weather is favorable in the spring. Where the range is used from the kidding corral by large herds during the greater part of the year, much of the choice forage is killed out or is greatly weakened by continuous grazing, so that the spring growth is greatly delayed and is scanty when it does come. As a result the does have to travel too far, are not sufficiently nourished during kidding time, and fail to provide ample milk and also to mother their kids properly. Under such conditions there is considerable trouble in handling the flock during kidding, and it is difficult to keep down the losses.

It is necessary to graze the does continuously from the kidding corrals during the kidding period and for two or three weeks after the close of kidding. Only strong, vigorous plants which have stored considerable food material in their roots during the growing period of the former year can withstand such continued, premature grazing. Accordingly, the does and kids should be moved to the summer-and-fall range just as soon as possible, so that the plants on the kidding range will have an opportunity during the summer growing season to make sufficient growth to insure an early, vigorous growth the following spring. If the goats are moved shortly after kidding and are not grazed on this spring area until the next spring, the plants will recuperate during the summer from the heavy early spring grazing and there will be no deterioration in the range forage.

The spring range should have enough forage so that the goats will be properly nourished during the period they are on it and no part of it be overgrazed. If there is surplus forage in the fall, it may be possible to graze it lightly, but care should be taken to see that the grass and weed forage is not grazed so much as to injure it, and that the buds of the brush are not consumed.

It is best to refrain from grazing the kidding range during the winter, and under no circumstances should the winter grazing on this range be more than very light.

Summer-and-fall range.—When the does and kids are removed from the kidding range they should be taken to the range set aside for summer-and-fall use. Since the kids depend largely upon their mothers' milk and upon green, succulent food for nourishment during the summer, there should be plenty of grass and weed forage on the summer range. Such forage when young may be injured by grazing. The forage, therefore, should be as far advanced as possible when grazing begins.

On the summer range it is necessary to graze the plants during their principal growing period and while they are producing their flower stalks and seed. The summer is also the most successful period for establishing seedlings. A normal plant growth, the production of

fertile seed, and the establishment of seedlings are most important; and the goat grazing should be adjusted so as to interfere as little as possible with these plant functions.

Continuous close cropping of the forage during the growing season removes the leaves of the palatable species as fast as they are produced. If the roots are not killed by starvation, they are often trampled out of the ground by the goats' hoofs. Hence the palatable species fail to reproduce and gradually disappear; and the unpalatable species, having a greater chance for growth and reproduction, gradually take the place of the palatable species. Only a very open stand is formed. Erosion follows, the valuable surface soil is washed and blown away, and reestablishment of the palatable forage cover is made most difficult.

This denuded condition prevails especially where grazing has been excessively concentrated around bed grounds used every night throughout the growing season. It is important, therefore, that goats be bedded in any one place for only a short period. This will not only eliminate the concentration of grazing but will also secure a more uniform utilization of all the range forage.

If the forage is given a complete rest, or is only lightly grazed during the growing season, the palatable vegetation has an opportunity to make normal growth. With normal growth fertile seeds are produced, the seedlings are given a chance to become established, and an appreciable increase in the palatable vegetation may result.

To ascertain the effect of giving the forage a rest from grazing, plots were established on seriously overgrazed, southwestern goat ranges; and for two years the areas were protected from grazing during part or all of the growing period, and closely grazed at other times, the browse, because of its scarcity, being overgrazed. The increase in density of palatable forage in the two years averaged approximately 67 per cent for grasses and 4 per cent for browse. The greatest increases were approximately 125 per cent for the grasses and 27 per cent for the browse. When overgrazed goat range is given a rest during the growing season and not overgrazed at other times, the grass recuperates readily. The brush recovers more slowly. When the range has been only lightly overgrazed the brush also recuperates readily with protection, but if the range has been badly overgrazed the brush requires several years before it makes normal growth.

When range is fully stocked it is not always possible to allow all the summer range a rest from grazing during the growing season. If the winter range and the summer-and-fall range can be interchanged advantageously each of these divisions can be given protection in different years; but it is often impossible to interchange them because snow prevents winter use of the range reserved for summer

F-4-WRC

FIG. 1.—GOATS GRAZING ON THE BRUSH UNDERSTORY OF THE TIMBER TYPE, SUMMER AND FALL RANGE.

F-50644

FIG. 2.—GOATS GRAZING IN THE OPEN BRUSH TYPE OF THE LOWER ELEVATIONS, WINTER RANGE.

F—27045—A

FIG. 1.—RANGE GRAZED BY GOATS CONTINUOUSLY FOR OVER 30 YEARS.

Destruction of the palatable forage cover, followed by erosion, results from continued heavy grazing.

F—31358—A

FIG. 2.—SAME RANGE AS SHOWN ABOVE AFTER PROTECTION FROM GOAT GRAZING DURING PART OF THE GROWING SEASON FOR TWO YEARS.

With protection the grass recuperates readily; the brush more slowly.

and fall. It is unnecessary, however, to give the entire summer-and-fall range a rest from grazing during the growing season. If it is stocked so as to prevent overgrazing, and if grazing is deferred on successive parts until after seed maturity and then the surplus forage utilized, all of the forage may be fully grazed and the vegetation maintained in a state capable of maximum production.

This system is known as "the deferred and rotation system of grazing."[1] For example, in the Southwest the summer-and-fall ranges are grazed from about June 1 to November 1, or approximately five months. The greater part of the principal forage species have matured seed by September 1. Grazing, then, should be deferred on certain successive parts until some time after this date.

To apply successfully the deferred and rotation system of grazing three points must be observed. First, the grazing must be distributed so as to avoid concentration to the point of overstocking. To do this with herds of about 1,200 grown goats will require the use of about 20 bed grounds on the summer-and-fall ranges. Second, the goats must be grazed quietly on range adjacent to each of the bed grounds, and different parts of the range must be grazed at different times of the period. This can easily be done by using 20 bed grounds. To use all the summer-and-fall range throughout the entire grazing period should not be attempted. Third, instead of using the bed grounds in the same order year after year, rotation in time of use by groups of four bed grounds each must be practiced.

This plan would make possible the division of the summer-and-fall range into five parts of equal carrying capacity, each part suitable for a month's use. Two parts, each containing four bed grounds, could then be protected from grazing until after September 1 each year. Each part grazed in any month for any given year should be grazed a month earlier in the succeeding year, except the part grazed first which would then be grazed last. For example, if the parts are designated by A, B, C, D, and E, in any year A, B, and C may be grazed during June, July, and August, respectively, leaving D and E to be grazed in September and October after seed maturity; then in the succeeding year B, C, and D would be grazed in June, July, and August, respectively, leaving E and A to be grazed in September and October, and so on. This would allow the forage around the four bed grounds grazed last each year a second year of protection until after seed maturity, and would give the seedlings from the first year's crop of seed a good chance to become established. Such a grazing system results in a five-year rotation with each fifth of the

[1] This system is described in detail by Arthur W. Sampson, "Natural Revegetation of Range Lands Based upon Growth Requirements and Life History of the Vegetation," Journal of Agricultural Research, U. S. Dept. Agri., Vol. III, No. 2 (Nov. 16, 1914), and by James T. Jardine, "Improvement and Management of Native Pastures in the West," U. S. Dept. Agri., Yearbook 1915, pp. 299–310.

range being given protection from grazing until after seed maturity two years in every five.

TABLE 1.—*Part of summer-and-fall range to be used during each month through a series of six years under the deferred and rotation system of grazing.*

[Letters indicate parts of range.]

	June.	July.	Aug.	Sept.	Oct.
First year	A	B	C	D	E
Second year	B	C	D	E	A
Third year	C	D	E	A	B
Fourth year	D	E	A	B	C
Fifth year	E	A	B	C	D
Sixth year	A	B	C	D	E

Winter range.—Under the present methods of management the goats on many ranges often lose much in weight during the winter, and occasionally many of them die. Where the range is grazed by large herds throughout the year or even throughout the entire winter, from the corral and shed at the winter ranch the browse in the vicinity of the camp is killed out or is weakened to such an extent that it provides very inadequate forage. When heavy snow comes the feed is still more scarce and goats must be fed if they are to maintain their weight.

To reduce the extra feeding required and to decrease the liability of loss, the winter range should be situated low enough to be out of the range of severe storms. It is also essential that enough forage be protected at other times of the year so that the goats may obtain ample feed during the winter without excessive traveling. The browse areas at the lower elevations generally furnish the best winter forage. Practice has shown that it is best to reserve the feed close to the shed for use during heavy snows and after shearing in the fall or late winter. In order to preserve this feed and prevent overgrazing, and still have the goats close enough to the shed to be brought in if a storm threatens, the goats may be bedded at a number of places about half a mile in different directions from the shed.

PREVENTION OF OVERGRAZING.

The most prominent signs of overgrazing are a reduction in the quantity of palatable forage, an increase in the nonpalatable plants, a stubby appearance in the browse species, an increase in the number of rocks showing above the soil, and a thinness in the goats due to insufficient nourishment. Signs of overgrazing which are not so readily noticed, but which should be watched for, are the failure of palatable species to flower and fruit, the removal of most of the leaves of important palatable browse species before fruiting, and the covering of considerable grass on slopes with sliding soil brought down by trampling.

If any of these conditions prevail, steps should be taken immediately to stop the overgrazing. The overgrazed areas should be protected from grazing until after seed maturity of the main forage plants, excessive concentration of grazing should be stopped, and the goats should be handled under the methods outlined in this bulletin. If this fails to eliminate the overgrazed condition, there are too many goats grazing the area allotted to them, and either the number of goats should be reduced or the area increased so that sufficient forage will be provided.

An average of approximately four acres of the grass-brush type and from three to six acres of the true-brush type, depending upon the palatability of the browse species, should be allotted to each goat for yearlong grazing. This is for normal utilization of the forage by goats when they are grazed alone under good management and kept in good growing condition. So many varying factors, however, enter into the grazing capacity of every range that even though goats are allotted a carefully ascertained area the range should be watched at all times and the number of goats adjusted to the available forage.

Plenty of fresh, palatable feed reduces the death rate and has a marked beneficial effect upon the mohair production, the growth of the goats, and the proportion of kids raised. Two goats in good condition producing 4 pounds each of high-class mohair may yield a greater net revenue than three goats in poor flesh producing only 3 pounds of mohair each. Therefore, instead of overstocking a range with a large number of low-grade goats, high-grade goats should be grazed to the number the range can conservatively carry. The net revenue will be just as great, if not greater, and the probability of occasional heavy losses will be largely eliminated.

MANAGEMENT OF A RANGE HERD OF GOATS.

The management of the goats is closely associated with the management of the range, and determines largely whether they will show a profit or loss. The effect on the forage is reflected in the growth and production of the animals using the range. In addition, methods of handling affect the animals directly. Bad management of goats on the range may offset all the good effects of careful range management and careful selection of the breeding herd.

SIZE AND COMPOSITION OF THE HERD.

On the range, goats are grazed in herds of from a few hundred head to over two thousand. General range practice has shown, however, that it is most economical to graze goats in herds of approximately 1,200 head of grown goats. Herds of this size produce the most satisfactory results. With herds of less than 1,200 average

range costs per goat are usually greater, and with herds of more than 1,200 grown goats more care is required in herding, and a greater number of bed grounds must be used to keep the goats in good condition and avoid damage to the range.

The breeding does should be grazed separately from the dry does, wethers, yearlings, and weaned kids. This allows the does to graze more quietly while with their kids and insures their being in better condition, which is especially important at breeding and kidding times. Range kids should be weaned at about five months of age. Buck kids older than this should never be allowed to run with the does, as they will often breed and otherwise cause much annoyance to the does. Wethers also annoy does at breeding time, and just before kidding may worry them sufficiently to cause abortions.

HERDING.

It is sometimes stated that a herder is not needed for goats, and it is true that a poor herder may be much worse than none at all. Small herds of a few hundred head or less may be watched successfully by a well-trained dog if there is an abundance of good range for the goats; but when the herds are large, and the range fully stocked, a herder is absolutely necessary to secure proper utilization of the forage, and to prevent trailing of the goats and loss from straying, accidents, and predatory animals.

Too often the method of range herding has been to keep the goats in a compact band and trail them over the range throughout the day with the object of keeping the entire herd together and in sight at all times. The herder and his dogs fall in behind the band and continue to push forward the rear goats, which are ordinarily the kids and the weak and crippled old ones. Such herding causes unnecessary traveling and prevents the rear goats from obtaining sufficient feed. The feed they do obtain is dirty and of inferior quality. The majority of the herd are kept in a medium or poor condition, the growth of a great many kids is stunted, and the running and bunching of the goats by dogs causes many cripples and a loss from leaving goats on the range.

Instead of being driven the goats should be grazed slowly, quietly, and openly, and the leaders should be held down to the rate the rear goats desire to take. As the goats leave the bed ground in the morning the leaders should be turned in the direction the herder wishes to graze the goats that day. Throughout the morning they should be allowed to drift slowly away from the bed ground. In the warm part of the day most of the goats will take shade under trees and bushes, but a few may graze intermittently during the entire day. In the afternoon the leaders should be turned into the herd and started toward the bed ground selected for the night. By taking the goats

back over the same area grazed in the morning it is possible to pick up any goats that have remained behind through failure to herd them carefully enough.

Ordinarily goats should be taken from the bed ground early in the morning and returned about sundown. On ranges where there is danger of foot rot resulting from wet grass, however, it may be best to hold the herd on the bed ground until about 7 a. m. Goats can not secure sufficient feed when driven over the range for only a few hours during the middle of the day. Accordingly, it is poor practice to hold them on the bed ground until late in the morning or bring them in early in the afternoon. Goats graze more quietly in the cool of the morning and evening, and thrive best when allowed four or five hours of quiet grazing at each of these periods and a rest on the range of from an hour to several hours during the heat of the day.

BEDDING.

Many herds of goats, regardless of size, are bedded in a corral at the main ranch throughout the entire year. Some growers, having observed the detrimental effects to range and goats of such a method, have used more bed grounds. However, this is only a step in the right direction. When just a few bed grounds are used with large herds there is considerable concentration of grazing, which may prevent proper growth of the goats. Range practice has shown that the more bed grounds used the greater the benefits to range and goats. This leads to the conclusion that the bedding-out system as used with sheep would be the most successful method for handling goats.

Single bed ground.—Bedding the goats on the same ground every night in the year prevents proper management of the range. A large area is overgrazed and trampled and the forage on the range is not utilized evenly. As the palatable species disappear from the overgrazed area the goats are forced to turn to the less palatable plants, and excessive traveling is required to secure fresh forage. The combination of these circumstances keeps the goats in a moderate or poor condition at all times of the year. They fail to make normal gains in weight, the does fail to give sufficient milk, and the growth and value of the mohair is lessened. The decrease in value of the mohair is due partly to the dust from the overgrazed area which adheres to the mohair, and partly to the uneven staple resulting from changes occurring in the condition of the goats.

Because of the lack of browse on the overgrazed area close about the bed ground much supplemental feed is required when snows cover the other range forage, and this increases materially the cost of goat production. The general practice, however, is to furnish very little supplemental feed, the result being suffering and loss. The goats become thin and it is extremely difficult to bring them back to good

condition during the remainder of the winter. Young animals quit growing and may even lose weight. The hardship, however, falls most heavily upon the does, whose physical condition in turn often prevents proper development of the unborn offspring.

In the spring at kidding time the weak and half-starved roots of the palatable grasses and weeds are unable to furnish fresh, green feed in sufficient quantity for the does. The amount of milk produced is lessened, and as a result many kids are either lost or become stunted. Occasionally some does die. Furthermore, weak does have considerable difficulty in mothering their kids properly.

The reasons advanced in favor of a single bed ground are its low cost, the advantage of having the goats at the shed each night, the proximity to water, the supposedly smaller loss from straying, and the difficulty of obtaining herders who will herd under any other method. Such reasons appear trivial in comparison with the detriment to the range and the goats and the possible injury to the general welfare of the community. The slightly increased cost of maintaining the goats as a result of changing their bed grounds is more than offset by the increased production of mohair and meat and the reduction in losses from death.

By having the goats at a shed every night throughout the year the principal value of the shed is lost. Goats prefer open bed grounds and seldom enter a shed unless the weather is very cold or very wet. Warm summer rains seldom cause any trouble, but cold rains may result in serious losses in the herd. Accordingly, it is best to graze the goats near the shed for several weeks after shearing and during stormy periods of winter, so that, if necessary, they may obtain shelter immediately. After the choice forage has been consumed for some distance from the shed as a result of yearlong grazing, it becomes necessary at critical winter periods to graze the goats far away from the shed so as to get fresh feed. As a result heavy losses often occur.

For protection in the winter and after shearing a single shed is all that is usually needed, but if the winter range is some distance from the range used at shearing time it is best to have a shed on each of these ranges. The shed should not be expensive, but it should be substantial and of sufficient size to prevent crowding. Where it is used only for shelter, 3 square feet of floor space per goat will suffice, but 5 square feet or more per goat is better. As dryness under foot is essential, the shed should be built on well-drained ground and the roof should be waterproof.

The loss from straying is thought to be greater when the goats are grazed from more than one bed ground. Small bunches of strays will often find their way back to a central bed ground, but without a central bed ground it is said that they do not know where to go. Experience with the use of many bed grounds has shown,

however, that where goats are quietly grazed for short distances from the bed ground each day the straying is materially reduced.

The bad results of the use of a single bed ground throughout the year are uneven utilization of the entire allotment, a large overgrazed area about the bed ground, poor condition of the goats throughout the year, decrease in the value of mohair produced, slow growth of goats, loss and suffering from lack of feed when snow is on the ground, and loss and stunting of kids at kidding time. In addition, there may be injury to timber reproduction, erosion, and even pollution of the water supply to such an extent as to necessitate exclusion of goats from the area.

Several bed grounds.—The use of several bed grounds at different places on the range aids materially in securing more even utilization of the forage over the entire allotment, lessens the concentration of grazing, and makes possible the recuperation of the overgrazed areas and the utilization of each part of the range at the most advantageous time. The improvement in the quality and quantity of the forage and the reduction in trailing and driving of the goats results in better growth of goats and mohair.

Representative kids in two herds using several bed grounds during the year showed 6.5 and 8.3 pounds greater increases in weight than was made by kids of the same grade in a herd using only a single bed ground for the whole year. The does in all three herds were practically the same size when grazing began. Those in the two herds using several bed grounds were kept in a superior condition, which aided materially in the growth of the kids. Kids of average size and condition in the two herds using several bed grounds weighed in the late fall an average of 38.3 and 40.1 pounds, respectively. Representative kids in the herd using the single bed ground weighed an average of only 31.8 pounds at the same time. In this herd a few kids of does in good condition averaged 44 pounds. In the other two herds some kids of does that were in very good condition throughout the summer weighed approximately 50 pounds.

It is seldom possible to apply successfully the principles of improved goat range management when only a few bed grounds are used. The use of many bed grounds, however, makes possible application of these principles. When a bed ground is used for only a short period the goats can be quietly grazed close by throughout the day. The longer a bed ground is used the greater distance it is necessary for the goats to travel for fresh feed. When a bed ground has been used a week, the feed around it is dirty, and since goats are fastidious animals they trail over much unused, soiled feed. The increased trailing is apt to cause overgrazing, at least to some extent. Just as soon as overgrazing begins to take place, and the goats must

either graze the less palatable species or travel farther to obtain more palatable feed, they will lose flesh and the growth of mohair will be impaired. It is highly desirable, therefore, to use many bed grounds and each one only so long as the goats can be grazed quietly near it throughout the day.

Bedding-out system.—The bedding-out system, which is followed successfully with sheep on western ranges, is the ideal bedding method toward which growers of goats should work. Under this system the goats would be bedded wherever night overtakes them. Open, quiet herding would be practiced, and the goats would be allowed several hours of quiet grazing in the cool of the morning and the afternoon and a rest in the middle of the day.

The bedding-out system can not be strictly adhered to during kidding, nor during periods of stormy winter weather, nor just after shearing, but its use at other times of the year is practicable and reserves the feed on the kidding range and near the shed for critical periods.

If the bedding-out system is used and the range properly managed, the maximum of forage is produced, forage is utilized to its best advantage, overgrazing is eliminated, and the goats have fresh feed at all times. This makes possible the grazing of a greater number of goats and secures greater production of meat and mohair. The mohair is cleaner and of a more even staple, which materially increases its value. The percentage of kids raised also is greater because the does are maintained in good condition, which is of especial value at breeding and kidding time and during the winter while the fetus is developing.

National Forest Regulation G–26 requires that on National Forests "sheep and goats must not be bedded more than three nights in succession in the same place, except when bedding bands of ewes during the lambing season; and must not be bedded within 300 yards of any running stream or living spring, except in rare cases where this restriction is clearly impracticable." The object of this regulation is largely to reduce damage to the range and danger of pollution of water supply resulting from prolonged use of the same bed ground. When the advantage to range and goats from the use of each bed ground for only three successive nights or less is realized many growers will adopt this method on the range.

WATERING.

How often goats are watered depends largely on the availability of stock water, the weather, and the nature of the forage. If the dew is heavy, the forage succulent, and the weather cool, goats can go without water for several days. When snow is available in winter

F-5-WRC

FIG. 1.—GOATS HERDED IN A COMPACT BAND.

When goats are trailed over the range in a compact band much feed is wasted through trampling, the goats are kept in medium or poor condition, normal growth is hindered, and loss from crippling and straying often results.

F-6-WRC

FIG. 2.—GOATS GRAZING QUIETLY UNDER LOOSE HERDING.

When goats are grazed quietly and are widely distributed over an area of about one-half mile in diameter, the forage is conserved, trailing and loss are reduced, and the goats are given a chance to make normal growth.

F-7-WRC

FIG. 1.—GOATS RESTING IN THE MIDDLE OF THE DAY.

Goats thrive best when allowed several hours of quiet grazing both in the cool of the morning and evening and a rest on the range during the heat of the day.

F-33918-A

FIG. 2.—BED GROUND USED THREE NIGHTS BY GOATS.

The forage is closely grazed but uninjured. Besides the goats, cattle also have bedded on this area. The use of many bed grounds for short periods makes possible the elimination of overgrazing, fresh feed at all times, greater grazing capacity, and greater production of mohair and meat.

F-8-WRC

GOAT RANGE USED FROM THE HEADQUARTERS RANCH THROUGHOUT THE YEAR FOR A NUMBER OF YEARS.

Yearlong use of the same bed ground results in a large overgrazed area, poor condition of the goats throughout the year, slow growth of goats and mohair, and much suffering and even deaths from lack of feed at critical periods. Continued yearlong use causes erosion and injury to timber reproduction.

F–19–WRC

FIG. 1.—TOGGLED KIDS IN THE SHADE OF THEIR INDIVIDUAL SHELTERS.

In the toggle system the kids are left toggled for eight or ten days, their mothers going out each day for feed.

F–27519–A

FIG. 2.—KID NUMBERED AND TOGGLED ON THE RANGE.

they can go without water for longer periods. When the forage becomes dry and the dews are light, wethers and dry does should be watered every other day and does with suckling kids should be watered every day.

Goats should be bedded away from water and grazed quietly to and from it. They should never be driven hurriedly to it, nor be allowed to "shade up" at water, nor be held there for more than an hour. An hour is usually sufficient time for them to obtain all the water they need. Often greater use of the range is made by bedding the goats away from water than would be possible if the goats were bedded at the few watering places. The success of this plan depends to a great extent upon the topography of the range, the presence or absence of enough water for camp use away from the stock water, and the cost of transporting water for camp use when there isn't enough.

SALTING.

Goats are more easily handled and thrive better if salted regularly at short intervals than if salted at long intervals. Rock salt is often placed on the bed ground, so that the goats can eat of it every night if they desire. Coarse granulated salt is fed either in small quantities every night or in larger quantities at intervals of approximately a week. It is ordinarily placed on rocks, in troughs, or in boxes to prevent waste and to keep it clean. It is believed best to feed every night, giving just the amount the goats will eat. If salt is fed at great intervals or if rock salt is used, the goats are apt to crowd and injure one another.

Medicated salt is fed by many growers with success, although some growers think that it may cause the goats to shed if fed too freely in the spring.

The amount of salt fed varies from about one-half pound to six pounds for each goat per year. However, it is probable that on most goat ranges three and one-half or four pounds per goat per year will prove to be most satisfactory. A greater amount should be fed when the range is green and succulent than when it is dry.

SHEARING.

Angoras are sheared once or twice a year. In the colder climates they are generally sheared once, in March or April. This gives a longer staple and a more valuable fleece than when they are sheared twice during the year, but the amount of mohair from the single clip is usually slightly less than from the two clips. In warm climates, especially in the Southwest, many Angoras are sheared twice during the year, usually in February or March and in September or

October. At the lower elevations of the Southwest many Angoras will often shed a considerable amount of mohair in the fall if not sheared at that time. In the mountains, however, growers shear twice to lessen the burden of carrying so much mohair during the winter and to prevent the loss of a large amount of mohair as a result of its being pulled out by the brush. One prominent New Mexico grower finds that it is most profitable to shear the kids in January and then shear the yearlings in the following fall. This gives two clips up to about 18 months of age in place of three, but a larger amount of fine, long-staple kid mohair is obtained.

Both hand and machine shears are used, but the latter are generally considered best. Fleeces should be rolled up inside out and packed, without tying, in sacks, or baled. Sacks that have been used previously for wool should never be used for mohair, because wool requires different dyes and whatever wool is left in the sacks must therefore be separated from the mohair before the mohair is manufactured.

DIPPING.

It is advisable to dip goats once or twice a year to rid them of lice, with which they are usually infested. Goats can not thrive to best advantage and carry lice; and in the winter especially infested goats will require more feed, and may become thin and produce a poor quality of mohair, and does may even fail to produce kids. Any of the common sheep-dip preparations are satisfactory.[1]

KIDDING.

To save a high percentage of kids, and thereby insure larger profits, special care must be given to does and kids during kidding. The suggestions in the following paragraphs may prove helpful in reducing loss and in facilitating the mothering and proper growth of the kids. These suggestions are for range herds of approximately 1,000 to 1,200 does; but, with slight modifications, they can be used successfully on any range and with a herd of any size.

THE KIDDING PERIOD.

The time and length of the kidding period are regulated by the service of the bucks. On most southwestern ranges kidding may start any time between February 1 and May 1, and may last from 30 to 45 days. To be certain of ample green feed and to insure proper growth of the kids before the June dry period comes and still avoid the danger of severe storms, it is generally best to have

[1] Full information regarding dipping of sheep will be found in Farmers' Bulletin 713, "Sheep Scab," Marion Imes, and Farmers' Bulletin 798, "The Sheep Tick and Its Eradication by Dipping," Marion Imes.

kidding start in this region not later than April 15 and last approximately 30 days.

On farms of the Northwest kidding usually starts in March or early April, just before the feed becomes plentiful. If there is an overabundance of fresh, green feed, the does overeat and exercise too little prior to kidding, and this, it is thought by growers, causes goitre among the kids. There is little danger of range does obtaining too much feed without exercising sufficiently in obtaining it; still, if the does are kidded in pasture this should be guarded against.

THE KIDDING CAMP.

Kids are generally very delicate when first born, and for several days can not stand much cold or rain. Furthermore, it is the general belief that they can not be grazed along with their mothers until several weeks old. Therefore, to facilitate the handling of the does during kidding, and to care for the kids until old enough for the range, a permanent camp should be established near water. The pens constructed at this camp should be kid tight; for the larger pens 34 or 36 inch woven wire, with the lower meshes small enough to prevent a kid getting its head caught, is preferable, but for small pens boards are best. A shed should be provided to give protection during storms. It may be made either with a permanent roof or with a framework of poles over which heavy canvas is temporarily stretched.

HERDING AT KIDDING TIME.

As most kids are born during the middle of the day, the drop band should be taken out to graze about 7 a. m. and brought in about 11 a. m., or before that if many kids are being dropped. By 3 p. m. most of the does to kid during the day have kidded or have shown signs of kidding, and may be separated from the herd. Then the drop band should be taken out again and kept out until sundown. Kids dropped on the range should be carried in and their mothers marked and brought in with the herd; or, if there are about 8 or 10 that kid on the range, the mothers may be brought in as a separate bunch from the main drop band.

The does which have kidded should be formed into a band each day and quietly grazed from about 9 a. m. to 4 p. m., the kids being left at the camp. A herder should be continually with the wet band (does that have kidded) to prevent its mixing with the drop band and to protect it from predatory animals. Grazing the wet band at some distance from the camp saves the feed close about camp for the drop band.

A crew of at least three or four men is necessary to attend the goats properly during the kidding period. One or two men should herd

the drop band. Another man should herd the wet band. While not herding, these men may work about the corrals. One other man, usually the foreman of the crew, is needed about the corrals at all times and to direct the work.

CARE OF DOES WHILE GIVING BIRTH TO KIDS.

If a doe while kidding is with the herd in a large corral, or even is with only a few other does in a medium-sized pen, there is danger of her disowning her kid. Among the preventable causes which may lead a doe to disown her kid immediately after kidding are, chiefly, separation of the doe and her kid, interference of other does or of other kids than her own, fright, and excitement. To persuade a doe which disowns her kid to mother it properly usually causes considerable trouble. If, however, the doe is kept quiet during kidding, and just afterwards is kept close to and alone with her kid, she ordinarily recovers quickly from her labor and fright and properly mothers her kid.

To have the mother in quietness while giving birth, and alone with her kid immediately afterwards, and to facilitate the giving of assistance to the doe if necessary, or to the kid should it fail to draw milk, individual kidding pens about 4 feet square should be provided. About 60 of these pens should be provided for a herd of 1,200 does, though it is well to have more if possible. At morning, noon, and night all does that show signs of immediate kidding should be quietly separated from the drop band by means of the shepherd's crook, and each doe placed by herself in one of the individual kidding pens. It is best to leave the does and their kids in the kidding pens until the following morning; but if there is a shortage of these pens, does that have kidded in the morning may be removed in the afternoon if they are properly mothering their kids.

CARE OF DOES AND KIDS.

There are two systems of handling the kids during the first few weeks of life, "the toggle system" and "the pen or corral system." In the toggle system the young kids are staked, while in the pen system they are turned loose in small pens. The does in either case are taken out to feed each day and are returned to the kids for the night.

The toggle system.—Formerly the toggle system was used in a very haphazard way, the kid being staked wherever it was dropped, or as near by as possible, under a bush or in some other place where it would have shade. The heavy losses and extra work incident to such methods caused progressive goat growers to improve the system. The best results are obtained by the methods outlined below, which are based upon the experience of these men.

When the doe has kidded and claimed the kid, the kid should be carried to the place where it is to be staked and the doe should be quietly brought along with it. The kid is then staked with a toggle

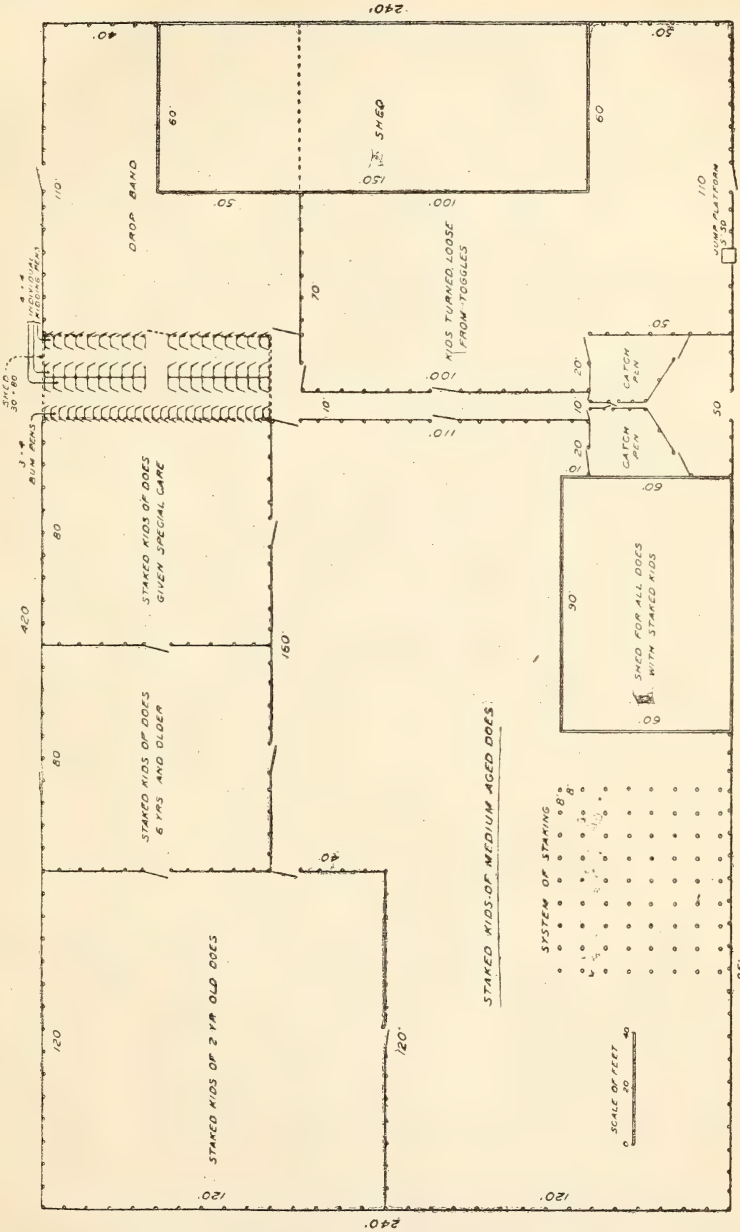


Fig. 1.—Plan for arrangement of pens and sheds for use in toggle system of kidding.

from 8 to 18 inches long, which is fitted with a swivel. Each staked kid should be furnished with an individual shelter to protect it from rain and heat. Shelters for this purpose are usually made of 12-inch boards in a gable or box form.

To facilitate care of does and kids and to lessen the chance of the does fighting, it is best to stake the kids in rows 8 feet apart each way, and separated in pens set aside for kids of old does, medium-

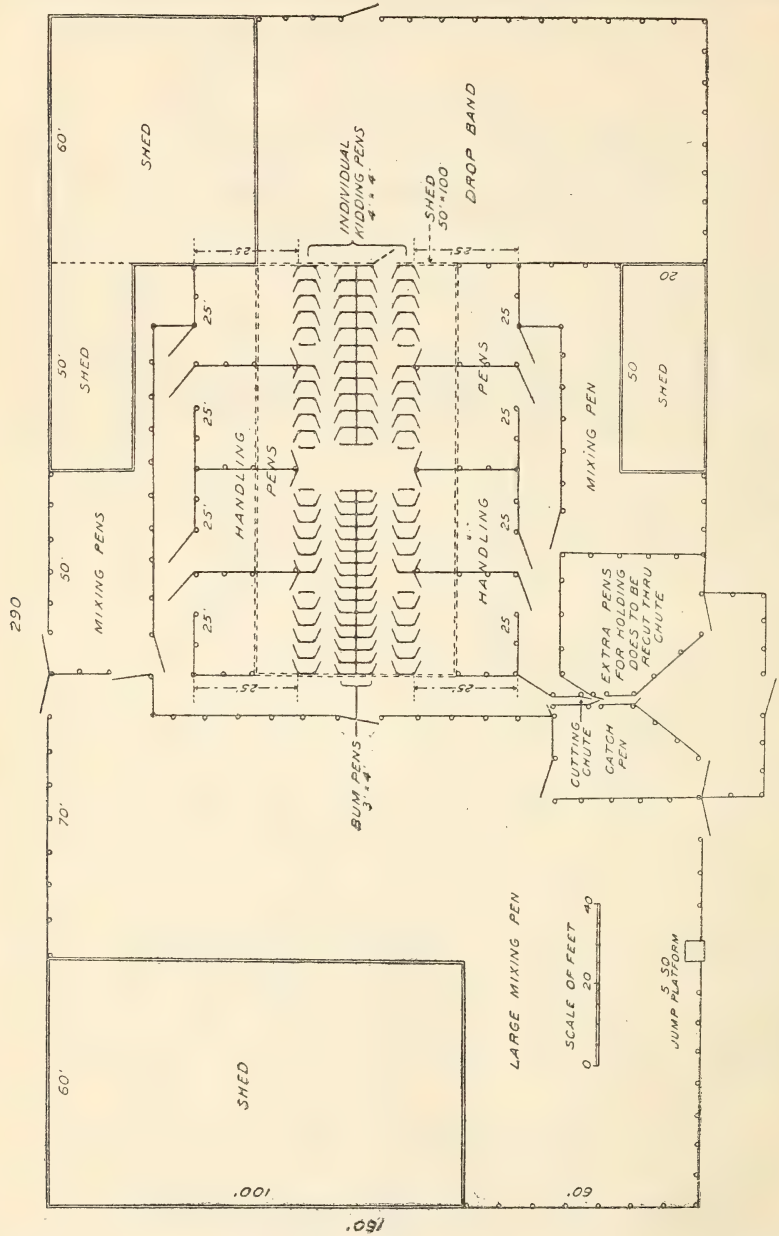


FIG. 2.—Plan for arrangement of pens and sheds for use in pen system of kidding.

aged does, two-year-old does, and does which have received special care. After the kid is staked, care should be exercised to see that the doe does not leave the kid for an hour or more. Then the doe is taken

out with the wet band to graze. In order to identify the doe and its offspring, should the doe fail to return to its kid or the kid break loose, each doe and her kid should be numbered with a tag or paint before the kid is staked.

Every day the toggles should be changed, the shelters straightened if need be, the hardened obstructions removed from the hind parts, and examinations made for scours, worms, and other troubles.

The kids should be left staked for at least eight or ten days. When turned loose from the toggles the kids should be removed from the staking pens to a large pen where they should remain until turned out to graze.

The pen system.—In the pen system the following procedure is now accepted as the best. After removal of the does and their kids from the kidding pens they are placed in handling pens suitable for holding about 50 does and their kids. These handling pens should be at least 20 feet square. For a herd of 1,200 does about 6 or 8 such pens should be provided. With small farm flocks and ample pasturage it may prove advantageous to place about 10 or 15 does with their kids in each handling pen and leave them together for from one to several days before grouping them into pens holding 50 does. Where pasturage is scarce, the range of low carrying capacity, and the herd large it is generally necessary to take the does out to graze while their kids remain in the pens. The necessity of cutting the does through a chute each evening upon their return from the range makes it impracticable to separate them for pens holding only 10 or 15 does. Very satisfactory results are obtained when 50 does are placed in each handling pen. Not more than this number, however, should be placed in a handling pen and ample room should be provided.

At all times the aim should be to group kids of the same age in the handling pens. If a difference of more than five days in age is allowed in any one handling pen, the older kids may cause considerable trouble to the does with younger kids.

When a doe and her kid are first placed in the handling pen care should be exercised to see that they are together. They should be left together and undisturbed for at least an hour before the doe is taken out to graze. Each doe should be marked with paint to show the pen in which her kid is left, and she and her kid should be marked or numbered so that they can be identified as belonging to each other. It is best to do this before removing them from the kidding pens.

When all the handling pens are filled, the does with kids several days old may be changed from several of the handling pens to a mixing pen. At least 6 or 8 square feet of space should be allowed in the mixing pens for each doe and kid. There should be two mix-

ing pens, so that the does and kids may be left in them for a week or more. The use of the mixing pens permits the does to become accustomed to finding their kids in a medium-sized bunch. Then when they are all placed together they seldom fail to find their kids. From the mixing pens the does and kids are moved into a pen large enough to hold the entire herd of does and kids. The kids remain in this pen until taken on the range.

Castration.—The buck kids not reserved for breeding purposes should be castrated when from a few days to three weeks old. This should be done early on a bright, cool morning and never on a rainy day. The lower one-third of the scrotum should be cut off with a sharp knife, then each testicle should be gradually worked down with the fingers and caught hold of, and either the testicle and spermatic cord should be pulled out, or when the spermatic cord is stretched it should be cut off at the base. All fatty matter attached to the cord should come out. Pulling of the testicles until the cord breaks is generally preferred. For several days the kids should be carefully watched. If flies are bad a disinfectant should be used.

Bucks in which only one testicle descends should have this testicle removed. They should be marked to distinguish them from wethers and should be killed or sold for meat as soon as practicable, for when a few months old they will bother the does. They make good meat when less than a year old.

Care of kids needing individual attention.—The kids which need individual attention are chiefly those which have been disowned by their mothers and those which have been given to does other than their mothers. Also, there are always a number of twin kids, kids of poor and weak does, and prematurely born and deformed kids that need special attention.

Even with the use of the individual kidding pens a doe may disown her kid because of severe pains in labor, lack of proper nourishment, or the doe's being without milk or having only a scanty supply. While the most critical time is right after the kid is born, there is danger even until the kid is several weeks old of the mother's disowning it for one or more of the following reasons: Rubbing together of kids dropped on the range in bringing them in, failure of a doe to find her kid, separation of a doe and her kid because of the fences not being kid tight, other kids than her own stealing the doe's milk, a doe's adopting some other kid than her own, fighting between does, or any unusual disturbance. Young does with their first kids and does with an insufficient amount of milk are the main offenders.

To assist in persuading the doe to own her kid small pens, generally known as "bum pens," 4 feet by 3 feet in size and with sides 3 feet high, should be provided. About 25 of these are needed to

meet any usual eventuality with a herd of 1,200 does. Any doe which fails to claim her kid is placed with it in a bum pen, the kid is suckled, and then they are left together until the doe needs feed and water. Each day the doe is grazed with the wet band and put back with the kid at night. The pen should be examined morning and night to see that the kid receives sufficient milk.

If the doe fights the kid it is best to hold her until the kid has suckled, but if other work is more pressing than this she may be tied to the side of the pen for a short time. It usually requires only one night in a bum pen for a doe properly to own her kid. Sometimes, however, does with a small amount of milk may require much longer.

One of twin kids is usually neglected by its mother. Even if she mothers both well, however, there is seldom sufficient milk, and the weaker of the two will probably be stunted unless given special nourishment. Some does will drop premature, deformed, or dead kids, or may lose good kids. If such a doe has a good flow of milk she may well be given a twin kid, a motherless kid, or a kid of a sick or weak doe. By using a bum pen and exercising care and patience a doe can be given the kid of another doe without difficulty. Often when the doe drops a dead kid she can readily be given another kid if the liquids expelled along with the dead kid are well smeared on the strange kid, especially on its hind parts, head, and belly. It will sometimes assist in having the doe claim another kid if the pelt is removed from her own kid and fitted on the kid being given her.

Kids of does giving a small amount of milk may usually be kept in better condition if their mother's milk is supplemented with milk from does having a surplus. Either does giving such a surplus may be milked by hand or the needy kids may be allowed to draw it. Care should be exercised in nourishing surplus kids being held for substitution, since the kid's stomach is very delicate. A new-born kid will usually not do well on milk of a doe which has given milk for several days, nor will an older kid do well on milk of a very fresh doe, because of changes which occur in the doe's milk from day to day.

It is usually necessary to assist for about a week a kid suckling a doe with extra large teats. Such cases, as well as sick does and does with weak or sick kids, can well be placed in bum pens or in a separate handling pen to facilitate the giving of extra care.

Starting the kids to graze on the range.—After kids are from a month to six weeks old it is best to give them some other feed in addition to their mothers' milk. If a pasture is available, the kids loose in the large pen may be turned into the pasture after the does have been separated and taken to the range. To separate the does from the kids it has been found best to use a platform from 16 to 18

inches high, over which the does pass in leaving the pen. As the herd approaches this the kids pass under it and the does go over. A substitute for the platform is a jump board, but with this there is danger of kids being crushed. If a pasture is not available, the larger kids may be allowed to go with the does when they are able to jump upon the platform as the herd is leaving the corral.

About two weeks after the close of the kidding period most of the kids may be taken with the herd. During the first few days that the kids are in the herd the entire herd is grazed only a short distance from the corrals. The distance is gradually lengthened as the kids become accustomed to going with the herd. Where the range is closely grazed, the does are taken out for their usual amount of grazing and when they are brought back to the corrals in the afternoon the kids are taken out with them for about a half hour's grazing close by. It is bad practice to herd the does and kids in separate bands. The kids obtain milk only at night while they are being grazed separately, whereas it is best for them, after they are several weeks old, to be able to get it at any time. Also separate grazing often makes it difficult to keep the does and kids together when placed in the same herd. When the kids are old enough to graze on the range with their mothers it has been found best to change from grazing the wet band during the middle of the day, as is done during the kidding period, to the general practice of several hours' quiet grazing in the morning and evening with a rest on the range in the middle of the day.

SELECTION OF GOATS FOR THE RANGE.

The goats on the ranges to-day are generally of two breeds—the Angora and the common, which is sometimes called the Mexican or Spanish-Maltese. In certain places near ranches a few head of the true milch breeds graze on the range. The Angora is by far the most important on the ranges both in numbers and the value of its products, and without doubt the principal increase in goats on the ranges will be in Angoras.

In connection with the study of range practices to determine the best methods of management, certain points regarding the type and grade of goats for the ranges were noted which it is deemed worth while to bring to the attention of goat growers generally. Large range herds of common goats and of low-grade Angoras often fail to yield sufficient revenue to pay for running them. Range Angoras vary so greatly in size, conformation, and production of mohair, and this has so great an effect on the profits of the industry, that a few suggestions as to selection of the goats making up range herds may assist materially in increasing the production of mohair and meat and in placing the industry on a more stable and remunerative basis.

TYPE AND GRADE OF GOATS FOR THE RANGES.

The greatest profits are made from the growing of pure-bred Angoras and the sale of the surplus for breeding. Very few range growers, however, are properly equipped to produce and dispose of valuable pure-bred breeding animals. The effort on most ranges, therefore, should be to produce high-class grade Angoras. Grade Angoras have been developed until the production of mohair from some of them equals the production from some pure-bred Angoras. Range herds of grade Angoras made up of young, fine-haired, heavy-shearing does and wethers furnish very substantial profits.

The mohair should be of fine, strong, even, long staple, be closely curled, pure white, lustrous, and as free from kemp as possible. It should also be dense on the animal, though fleeces of equal length and weight are more dense on a small animal than on a large one. Mohair becomes coarser as the age of the goat increases. Mohair from kids is very fine, and that produced by yearlings,[1] while coarser, is often sold as kid mohair. The very fine mohair not only brings a higher price but is much more easily marketed. Accordingly effort should be exerted to produce mohair of fine quality on all the goats, and just as much high-quality kid mohair should be produced as is possible.

The quantity of fine mohair produced by grown does and wethers varies from 1½ to 9 pounds, the average being about 3½ pounds. Better selection of the present range-breeding stock and better care and management should make possible an average annual production of at least 4 pounds of fine mohair per range goat. While this is an increase of about 15 per cent over the present range average, 4 pounds is so far below what some Angoras produce that the average should increase much above this by further improvement.

Most range growers have emphasized the mohair side at the expense of other desirable qualities. Where mohair alone is the object and the production of meat has been lost sight of, it is sometimes difficult to make a profit from goats during times when the market for mohair is dull. With a dual-purpose type of Angora, raised for the production of both meat and mohair, the double revenue not only furnishes a greater profit at all times but insures a profit when either the mohair or slaughtering market is dull.

Range Angoras should be heavy producers of fine mohair, but they should also have a large, plump, symmetrical body and a good constitution. The body and chest should be relatively broad and deep, the shoulders broad and nearly flat, the back wide and straight, the thighs full, the ribs well sprung, and the legs short, strong, and

[1] "Yearling" is used throughout this bulletin to mean a goat in the second year of its life.

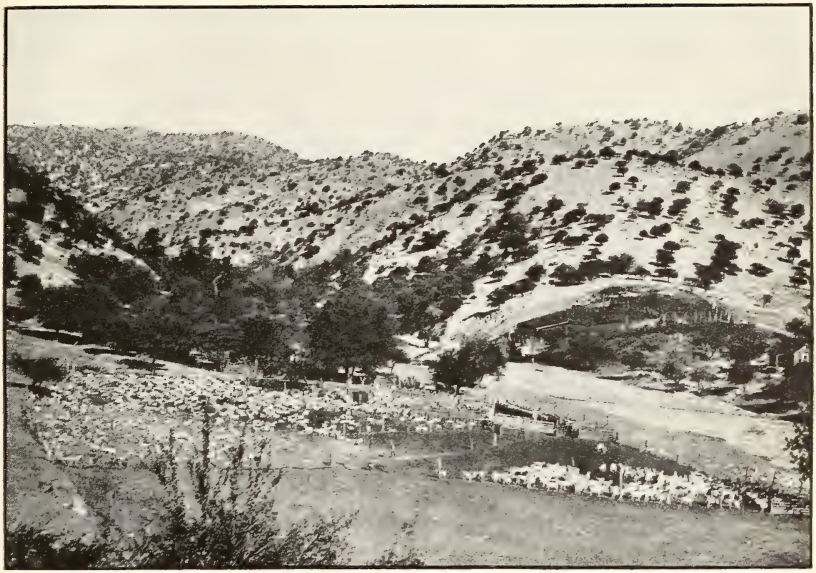
set wide apart. Such dual-purpose Angoras make possible a substantial double revenue from two sources, mohair and the sale of animals for meat. Heavier and earlier maturing animals are produced, which have a more ready sale and a greater value for meat, because there is less waste and a greater proportion of valuable cuts on the animal. This makes it possible to sell at a profit poor producers of mohair when about 6 months of age, and all surplus can be sold advantageously when 18 months or 2 years old.

In weight, grown Angoras vary from 60 to 150 pounds for both bucks and does, though the average is approximately from 100 to 125 pounds for bucks and 75 pounds for does. In the fall, kids of fine-mohair goats weigh, in good condition, from 30 to 75 pounds, with an average of about 35 to 40 pounds, and yearlings from 50 to 100 pounds or more, with an average of 60 to 65 pounds. Better selection of breeding animals from the present range Angoras to approximate the dual-purpose Angora as herein suggested, together with better care and management, will result in the production of kids averaging 50 pounds and yearlings averaging 80 pounds in the fall of the year. This is an increase of from 25 to 30 per cent over the averages to-day. These weights can be increased still further.

The disposal of surplus animals has always been one of the drawbacks of the goat industry. Though several hundred thousand are annually slaughtered, goats are usually placed on the market in small numbers of all ages and sizes and in all conditions of flesh. This has often made it impossible to establish a market classification and has generally caused slaughterers to pay only such prices as would insure a profit on the poorer animals. The production of the dual-purpose type of Angora under good management and the disposal of the surplus when 2 years old or under would make possible the placing of large numbers of well-built, fat goats on the market. With a steady supply of large, fat goats of even size and condition a better market for goats and goat meat might be established.

The type and grade of goat, then, that should be raised on the ranges is a large, well-built, early maturing Angora, producing a large quantity of fine mohair. The herd should be as uniform as possible. Uniformity of the mohair in the fleece and from the herd, reducing the work of grading, increases the value of the mohair. Also uniformity in size and conformation of the surplus stock sold for meat causes it to bring a higher price.

Selection of does.—The does making up the herd should be carefully selected for uniformity, and as nearly as possible to approximate the ideal range goat. In general, high-class does produce high-class offspring. Considering present prices, each doe should produce



F-10-WRC

FIG. 1.—GENERAL VIEW OF PENS USED IN THE PEN SYSTEM OF KIDDING.

F-27047-A

FIG. 2.—KIDS IN THE HANDLING PEN ADJOINING INDIVIDUAL KIDDING PENS.

In the pen system the does and kids are removed from the individual kidding pens to handling pens, where the kids in groups of about 50 remain for several days before being moved to mixing pens capable of holding the kids from several handling pens.

F-11-WRC

AN EXCELLENT TYPE OF BUCK—FIVE MONTHS' FLEECE.

The type of Angora that should be grazed on the range is a heavy producer of fine mohair, with a large, plump, symmetrical body.

F-12-WRC

AN EXCELLENT TYPE OF DOE—FIVE MONTHS' FLEECE.

The does making up the herd should be carefully selected for uniformity, and as nearly as possible to approximate the ideal range goat.

F-27044-A

FIG. 1.—YOUNG KIDS SHOULD BE PROVIDED WITH SHADE.

When turned loose from the toggles or removed from the mixing pens, the kids are removed to a large pen where they remain until old enough to graze.

F-13-WRC

FIG. 2.—DOES LEAVING LARGE PEN OVER PLATFORM.

As the does go over the kids pass under the platform and are not injured by crowding.

mohair of sufficient amount and value to cover approximately the cost of maintenance, so that the offspring is nearly clear profit. All does should produce sufficient milk to insure proper growth of the kids, and any range does that refuse to claim their kids or fail to give birth to kids after two years' trial should be disposed of.

Range does should be sold for meat at approximately 6 years of age at the latest, because at that age the mohair has become so light in weight and so coarse, and the milk supply so uncertain that they are apt to be unprofitable. The practice of retaining unprofitable does just as long as they are capable of producing offspring has been responsible for much of the low profit from goats.

Selection of bucks.—The bucks are the most important animals in the herd, and should be of as high breeding as is economically possible. Every buck should more nearly approximate the ideal than any of the does. Bucks of superior breeding usually stamp their characteristics on the offspring. If the bucks are of high quality, the herd can be improved through the retention of the high-class offspring. The bucks should not only show quality and quantity of mohair, but also should be of good size and symmetrical build, and should have a good constitution and two well-developed testicles.

Disposing of wethers.—Every wether retained in the herd takes the place of a doe on the range. The greater the proportion of does in the herd the greater the number of kids raised, and the greater the proportion of kid mohair in the clip from the entire herd. As before stated, the kid mohair brings the highest price and is the most readily sold. Therefore, if the wethers are to be retained in the herd they should be able, other factors being equal, to produce a net revenue over running expenses equal to the net revenue from the same number of does, and in determining this the possibility of selling the wether mohair should be carefully considered. The net revenue from does is considered as the total revenue from the does' mohair, the value of the kids and of the kids' mohair at 1 year of age, less the total cost of maintaining the does and kids during the year.

Both wether kids and doe kids which produce a poor quality of mohair should be disposed of either as fall kids or when 1 year old. It will be found most economical to sell the bulk of the other wethers as fall yearlings or when 2 years old. Up to this age there is the greatest production of fine mohair and the greatest gain in weight. Few wethers after 2 years of age can produce a net revenue from mohair and increase in value as a result of gain in weight equal to the does' net revenue, and therefore should be sold. Only wethers producing a very large quantity of fine mohair should be retained after they are 2 years old.

BREEDING.

The time of mating depends largely on the time when it is best for the kids to come. The period of gestation is from 147 to 155 days, and the time of mating is adjusted accordingly.

BUCKS.

Bucks to be used for breeding should be over 18 months of age. They should be kept in a thrifty, growing condition throughout the entire year, but particularly so during the mating season. Before breeding, the mohair should be clipped from the underside of the buck.

The number of does a buck may serve depends largely on the methods used. When the bucks are turned loose on the range with the herd there should not be more than 40 does to each buck. When the bucks are kept up in the daytime and fed grain in addition to pasturage, and are placed with the does only for the night, a buck can often serve more than 50 does, especially if it is desired to have the kids come well distributed through about 30 or 35 days, as is usually the range practice. By careful handling of the bucks some growers have had good success using one buck for about 80 does. In such cases the bucks are well fed and are placed with the herd only at night. With the possible exception of a few nights during the breeding season, only half the bucks are placed with the herd one night and the other half the next night. They are mixed so that if there is an exceptionally thrifty one and one that is not thrifty, these are placed with the herd on the same night. No two bucks that fight are placed with the herd on any one night.

DOES.

Does come in heat about the latter part of August or the first of September, and, unless mated, have periods of about three days in heat at intervals until January. Before breeding the mohair should be clipped from the hind parts of the doe well under the tail.

The does should be in good condition at the time of breeding. They should not be bred until they are 18 months of age. With small does it will often prove best to allow them still another year's growth before breeding. This gives them a chance to attain full growth, and as dry young does they will furnish a greater amount of valuable mohair than if they are nursing kids. When small does are bred at 18 months of age and raise a kid during their third year, they often fail to have a kid the next year and are usually permanently stunted, and their kids are generally small.

COSTS AND RECEIPTS.

COSTS.

The cost per head of running goats varies rather widely between herds. The items making up this expense are feed, loss, depreciation, labor, buck service, interest on investment, and other miscellaneous costs. These costs vary considerably with variation in efficiency of management, economic location, topography of the range, improvements and equipment necessary, labor supply, and the demand for range by other classes of stock.

On southwestern ranges very little feed other than range forage is provided except for the bucks. The cost of such range feed in Arizona and New Mexico is often small since the goats are generally run on public domain free of charge or on National Forests for a small fee. Where it is necessary to graze them on private or leased land, as is sometimes done in these States and nearly always in Texas, the interest on the investment in the land or the lease fee generally increases the forage cost. In the Northwest the cost for supplemental winter feed usually increases the total feed charges.

The loss by death in the Southwest is generally about 10 per cent of the grown goats, and is due mainly to predatory animals but somewhat to poisonous plants, disease, straying, adverse climatic conditions, and in a few cases to starvation. In many herds the average loss is much less than 10 per cent, often being less than 5 per cent.

The depreciation in wethers is practically nothing if they are not retained too long. In does the depreciation varies from 5 to 10 per cent annually. Where there is a good market for goats as meat the depreciation may even be less than 5 per cent.

One or two herders are provided per herd of 1,200 to 1,500 grown goats. Mexicans are generally employed and up to 1917 received wages of from $20 to $60 per month and board. During 1917 and 1918 it was often necessary to pay higher wages than these. A camp tender is sometimes provided for each herd or for several herds if owned by the same person. The camp tender's wages are about the same as the wages of the herders. A manager is sometimes hired for a large outfit. Two or more extra men are required for from one to two months at kidding time with each herd of 1,000 to 1,200 head.

Buck service costs vary widely in different herds, because of variation in the value of the bucks, the number of does allowed for each buck, whether they are traded with neighbors after two or three years' use, and the feed and care given. The average value of bucks used in range herds is $35 to $50.

There are a number of other miscellaneous costs. Shearing, which is done once or twice a year, usually costs about 4 to 8 cents per head for each shearing. Salt is usually furnished at the rate of from 1½ to 4 pounds per goat per year. Goats are dipped once or twice a year for lice at a cost of about 2 or 3 cents per goat for each dipping. Interest on the investment, taxes, depreciation of improvements and equipment, which includes maintenance and repairs, and minor costs of running, also add to the total.

In a number of New Mexican range herds of Angoras grazing on National Forests, and made up of does and wethers, it was found that, exclusive of interest on investment and owner's labor, the annual cost of running the yearlings and wethers during 1915 and 1916 varied from about 95 cents to over $2 per head, and the cost of running the does and their kids varied from about $1.62 to $2.78 per doe. In some herds it costs more than the highest figure given here; but few herds can be run for less than the lowest figure under such conditions as prevailed in 1915 and 1916.

RECEIPTS.

The receipts vary widely in different herds, mainly because of variation in the type and grade of goats and in the care and management they receive. The receipts from does are materially affected by the percentage of kids raised. This percentage based on the number of does bred varies on the range from about 50 per cent to nearly 100 per cent, though the average is about 60 per cent. The receipts from goats include receipts from mohair, net receipts from sales of goats which were on hand at the beginning of the year, the value of the kids raised during the year, whether sold or retained in the flock, and miscellaneous receipts.

The average gross receipts during 1915 and 1916 from grown wethers in the herds studied were about $2 per head or slightly more. From yearlings the receipts were higher, because the mohair from goats of this age is of high quality, a large amount is produced, and there is a considerable increase in value of the animals as a result of gain in weight. The total receipts from does, which include receipts from kids up to 12 months of age, were usually higher than from either grown wethers or yearlings. The total annual receipts during 1915 and 1916 from average does in the range herds of grade goats studied varied from about $3 to more than $5.50 per doe.

SUMMARY.

On far western ranges goats are raised mainly for mohair and meat and secondarily for milk and hides. There is need for improvement in methods of management in order to eliminate damage to the range so common on goat ranges and to place the industry on a better financial basis.

Range suitable for goats should possess a mixture of browse, grasses, and weeds, be free from continued heavy rains and snows, and be well supplied with bed grounds and watering places.

For proper management of any goat range the forage should be utilized in such a manner as best to meet the needs of range and goats. The entire range should be divided for seasonal use into three parts, spring range, summer and fall range, and winter range. The grazing on these divisions should be of such intensity and distribution as to secure a uniform utilization and to allow the forage to make sufficient growth to maintain itself.

The spring range must necessarily be grazed heavily at that time, but it should not be overstocked and should be protected from grazing at other times of the year.

The summer-and-fall range, containing the forage at the higher elevations, must usually be grazed during the growing period of the vegetation. The grazing, accordingly, should be well distributed and should be deferred until after seed maturity on successive parts of the division so as to insure proper revegetation.

The winter range, located on areas low enough to avoid severe storms, should be reserved for winter grazing only, in order to insure an ample supply of suitable winter forage. The grazing should be well distributed over the division, and the range close to the sheds should be reserved for use during stormy periods only.

Overgrazing causes deterioration of the range, erosion, injury to timber reproduction, and impairment of the growth of goats and mohair. Excessive overgrazing may even cause serious loss and suffering among the goats at critical periods. The number of goats should be regulated so as to prevent overgrazing.

Plenty of fresh, palatable feed has a marked beneficial effect on mohair production, growth of the goats, percentage of kids raised, and proportion of losses. Therefore, instead of overstocking a range with a large number of inferior-grade goats, the producer should graze high-grade goats to the number the range can conservatively carry. The net revenue will be just as great if not greater.

On the range it is most economical and gives the most satisfactory results to graze goats in herds of about 1,200 head. It also proves best to graze breeding does separate from dry does, wethers, yearlings, and weaned kids.

Open, quiet herding, and grazing of the goats for four or five hours both in the cool of the morning and the cool of the evening with a rest on the range during the heat of the day is the most successful method.

The use of the same bed ground throughout the year results in uneven utilization of the forage, a large overgrazed area about the

bed ground, poor condition of the goats throughout the year, slow growth of goats and mohair, and much suffering and even deaths at critical periods. In addition, the use of a single bed ground may cause injury to timber reproduction, erosion, and possibly a pollution of the water supply.

The use of many bed grounds makes possible a more even utilization of the forage, the elimination of overgrazing, the recuperation of the overgrazed areas, the use of the forage at the most advantageous time, the reserving of an ample supply of suitable feed for critical periods of the year, and in short the successful application of proper range management. The benefits to the range of proper management, the elimination of driving and trailing of the goats, and the possibility of having the goats on fresh choice feed at all times not only permit the grazing of a greater number of goats but also result in raising a greater percentage of kids and in greater growth of goats and mohair. The mohair is of greater value because it is cleaner and of a more even staple.

The success attained by the use of many bed grounds leads to the conclusion that the bedding-out system, whereby the goats are quietly and openly grazed for short distances during the day and bedded where night overtakes them, would give even better results to range and goats and allow for the grazing of even a greater number than where each bed ground is used for only several consecutive nights.

The kidding range should be so located, and the time of kidding so adjusted, as to avoid severe storms and to insure ample green feed. The use of individual kidding pens, good management in either the toggle or pen system, care in seeing that each doe properly mothers her kid, and that motherless kids are given to does which have lost their kids will result in a larger and more thrifty kid crop.

The range goat should be the large, well-built, early-maturing Angora, producing a large quantity of fine mohair. The does should be uniform, of good size, have good constitutions, be good producers of mohair, and should produce sufficient milk to insure proper growth of kids. The bucks should more nearly approximate the ideal than the does; they should be large, vigorous, and producers of a large quantity of high-quality mohair. Only those wethers which produce a very large quantity of fine mohair should be retained in the herd after they are two years old.

For breeding purposes both the bucks and does should be in a thrifty condition and over 18 months of age. When bucks are placed with the does at night and are fed grain in addition to good pasturage they may serve 50 or more does with success.

In a number of New Mexican range herds of Angoras it cost, during 1915 and 1916, exclusive of interest on investment and owner's labor, from about 95 cents to over $2 per head per year for running wethers. For the same years the average annual gross revenue per grown wether from these herds was approximately $2. From yearlings the gross revenue was somewhat greater.

In the same herds and during the same years the annual cost of running the does and their kids varied from $1.62 to $2.78 per doe. The average annual total revenue per doe varied from about $3 to more than $5.50.

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